



# GRID-CONTROLLED RECTIFIER CIRCUITS

## Numerical Relationships Among Electrical Quantities

$E$ = Trans. Sec. Voltage (RMS)	$I_{av}$ = Average OC Output Current
$E_{av}$ = Average DC Output Voltage	$I_b$ = Average Anode Current
$E_{bmi}$ = Peak Inverse Anode Voltage	$I_p$ = Anode Current (RMS)
$E_m$ = Peak OC Output Voltage	$I_{pm}$ = Peak Anode Current
$E_r$ = Major Ripple Voltage (RMS)	$P_{al}$ = Line Volt-Amperes
$f$ = Supply Frequency	$P_{ap}$ = Trans. Pri. Volt-Amperes
$f_r$ = Major Ripple Frequency	$P_{as}$ = Trans. Sec. Volt-Amperes
$P_{dc}$ = DC Power ( $E_{av} \times I_{av}$ )	

Note: Conditions assumed involve sine-wave supply; zero voltage drop in tubes; no losses in transformer and circuit; no back emf in the load circuit; and no phase-back.

RATIO	Fig. 1	Fig. 2	Fig. 3	Fig. 4	Fig. 5*	Fig. 6	Fig. 7	Fig. 8
<b>Voltage Ratios</b>								
$E/E_{av}$	2.22	1.11	1.11	0.854	0.854	0.427	0.785	0.74
$E_{bmi}/E$	1.41	2.83	1.41	2.45	2.45	2.45	2.83	2.83
$E_{bmi}/E_{av}$	3.14	3.14	1.57	2.09	2.09	1.05	2.22	2.09
$E_m/E_{av}$	3.14	1.57	1.57	1.21	1.05	1.05	1.11	1.05
$E_r/E_{av}$	1.11	0.472	0.472	0.177	0.04	0.04	0.106	0.04
<b>Frequency Ratio</b>								
$f_r/f$	1	2	2	3	6	6	4	6
<b>Current Ratios</b>								
$I_p/I_{av}$	1.57	0.785	0.785	0.578	0.289	0.578	0.5	0.408
$I_b/I_{av}$	1	0.5	0.5	0.33	0.167	0.33	0.25	0.167
<i>Resistive Load</i>								
$I_{pm}/I_{av}$	3.14	1.57	1.57	1.21	0.52	1.05	1.11	1.05
$I_{pm}/I_b$	3.14	3.14	3.14	3.63	3.14	3.14	4.5	6.3
<i>Inductive Load</i> <sup>■</sup>								
$I_{pm}/I_{av}$	—	1	1	1	0.5	1	1	1
<b>Power Ratios</b>								
<i>Resistive Load</i>								
$P_{as}/P_{dc}$	3.49	1.74	1.24	—	—	—	—	—
$P_{ap}/P_{dc}$	2.69	1.23	1.24	—	—	—	—	—
$P_{al}/P_{dc}$	2.69	1.23	1.24	—	—	—	—	—
<i>Inductive Load</i> <sup>■</sup>								
$P_{as}/P_{dc}$	—	1.57	1.11	1.71	1.48	1.05	1.57	1.81
$P_{ap}/P_{dc}$	—	1.11	1.11	1.21	1.05	1.05	1.11	1.29
$P_{al}/P_{dc}$	—	1.11	1.11	1.21	1.05	1.05	1.11	1.05

\* Bleeder current of 2% full-load current will provide exciting current for balance coil and thus avoid poor regulation at light loading.

■ The use of a large filter-input choke is assumed.



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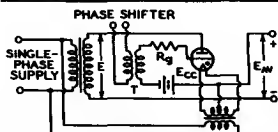


FIG. 1 HALF-WAVE SINGLE-PHASE

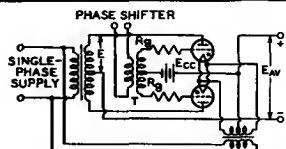


FIG. 2 FULL-WAVE SINGLE-PHASE

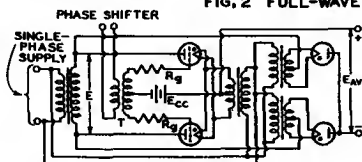


FIG. 3 SERIES SINGLE-PHASE

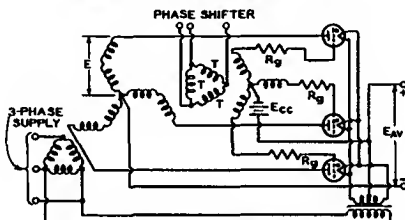


FIG. 4 HALF-WAVE THREE-PHASE

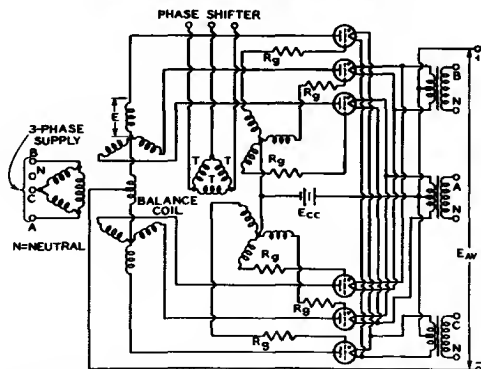


FIG. 5 PARALLEL THREE-PHASE (QUADRATURE OPERATION)

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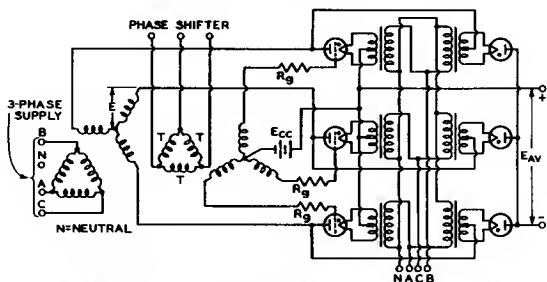


FIG.6 SERIES THREE-PHASE (QUADRATURE OPERATION)

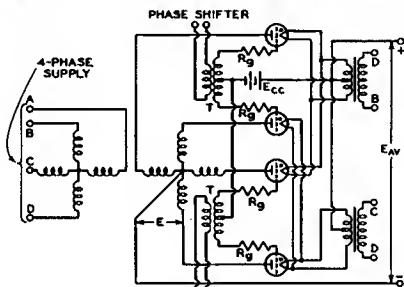
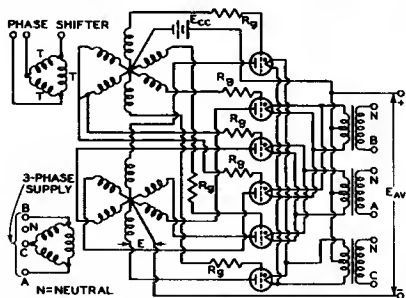


FIG. 7 HALF-WAVE FOUR-PHASE (QUADRATURE OPERATION)



**FIG. 8 HALF-WAVE SIX-PHASE (QUADRATURE OPERATION)**

### NOTE

T=PEAKING TRANSFORMER

**92CL-8340**